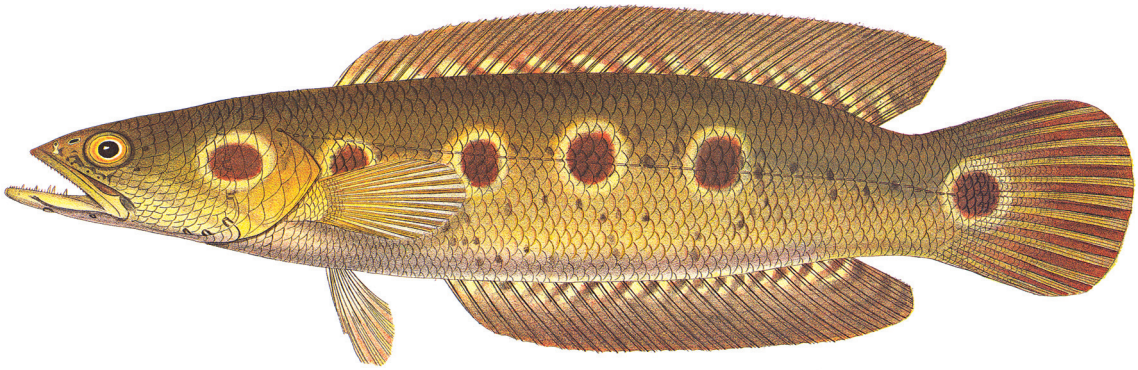
Channa pleurophthalma (Bleeker, 1851)
Ocellated Snakehead



After Bleeker, 1878

Original description: *Ophicephalus pleurophthalmus* Bleeker, 1851:270. Nieuwe bijdrage tot de kennis der ichthyologische fauna van Borneo mit beschrijving van eenige nieuwe soorten van zoetwatervisschen. Natuurkd. Tijdschr. Neder. Indië 1:259-275. Type locality: Bandjarmasin, Borneo, Indonesia. Syntype and/or Bleeker specimen: BMNH 1880.4.21.123.

Synonyms: *Ophicephalus urophthalmus* Bleeker, 1852:578.

Ophicephalus spiritalis Fowler, 1904:530, pl. 9, *fide* Roberts, 1989:170.

Common names: **ocellated snakehead**; eyespot snakehead; kerandana (Kalimantan).

Native range: Padang (?) and rivers (Hari and Musi basins) of southeastern Sumatra; Kapuas and Barito basins of Kalimantan (southern and southwestern Borneo; Roberts, 1989; Kottelat and others, 1993). Absent from peninsular Malaysia (Ng and Lim, 1990).

Introduced range: Introductions unknown.

Size: To 40 cm.

Habitat preferences: No information found, but probably a riverine species.

Temperature range: No information found. Nevertheless, native range is equatorial, indicating a solely tropical species.

Reproductive habits: No information found, but likely a nest builder as are most other snakeheads.

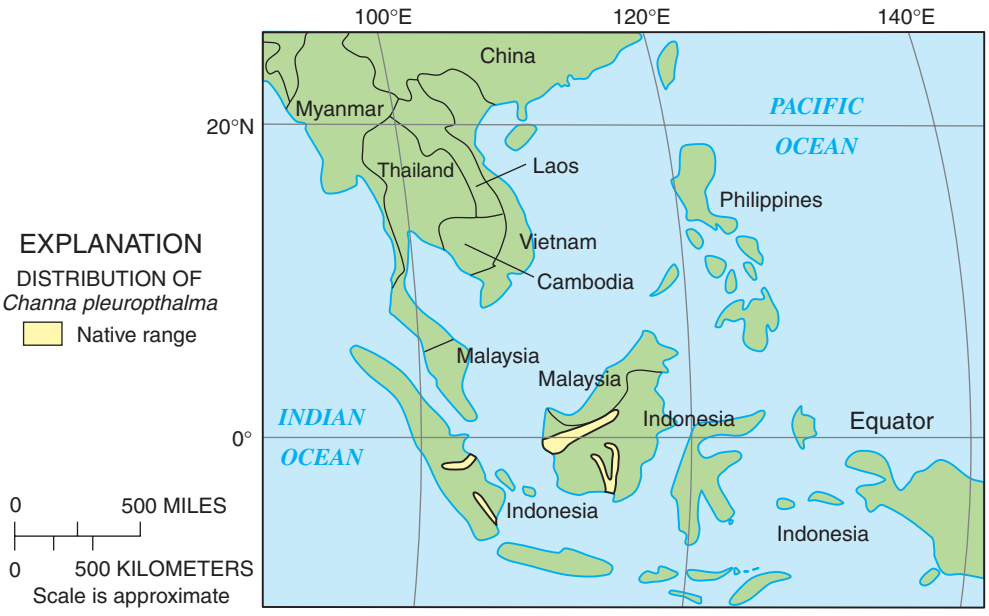
Feeding habits: No specific information, but likely a predator as are other snakeheads.

Characters: Patch of scales on gular part of head. Dorsal fin with 40-43 rays; anal fin with 28-31 rays. Lateral line scales 57-58; scale rows between lateral line and anterior base of dorsal fin 5½. Single row of canine-like teeth on prevomer; single row of small teeth and single row of 4-5 canines on palatines. Four to five prominent ocelli on sides of body, anterior-most ocellus on opercula, usually 3 to 4 on body (Kottelat and others, 1993).

Commercial importance in the United States: Often listed on aquarist-oriented websites. This species has attractive markings (red to yellow ocelli) on the body that has made it of interest to aquarists. Ng and Lim (1990) indicated it to be among the two highest-priced aquarium fishes. Not known for sale in live-food fish markets.

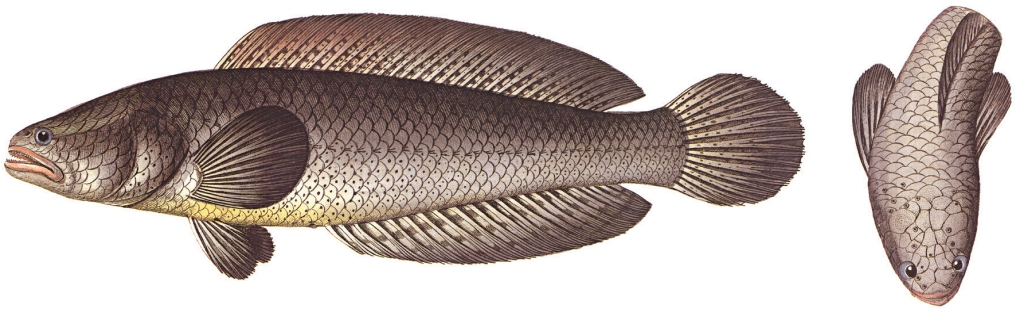
Commercial importance in native range: Kottelat and others (1993) indicated *Channa pleurophthalma* as an important food fish in Indonesia and Sumatra. Lee and Ng (1991) noted that it is sold in markets of Sumatra and Kalimantan. Dudley (2000) reported it in the fishery of Danau Sentarum Wildlife Reserve, Kapuas River, Kalimantan.

Environmental concerns: Ng and Lim (1990) stated that the aquarium fish trade is growing in Indonesia and Malaysia, indicating that this species, among others, may have become more readily available for sale in the U.S. Like other snakeheads, this species is probably a thrust predator. Nevertheless, it is an equatorial species that could probably survive in very few waters (thermal springs, perhaps extreme southern peninsular Florida, and Hawaii) if introduced into the U.S.

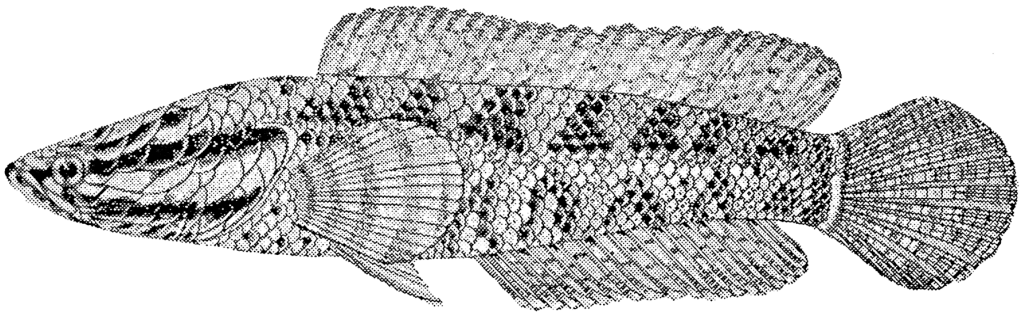


Channa pleurophthalma

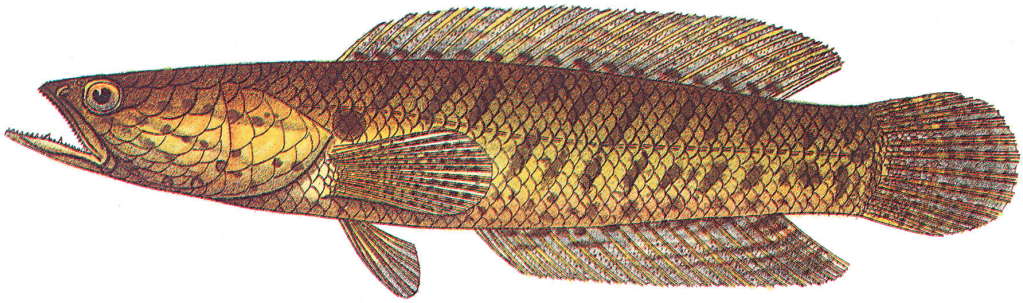
Channa punctata (Bloch, 1793)
Spotted Snakehead



After Bloch, 1793; images reversed from original pl. 358



After Munro, 1955



After Bleeker, 1878

Original description: *Ophicephalus punctatus* Bloch, 1793:139, pl. 358. Naturgeschichte der Ausländischen Fische, 7:i-xiv + 1-144, pls. 325-360. Type locality: rivers and lakes of Malabar coast, southwestern India. Syntype: ZMB 1394.

Synonyms: *Ophicephalus karruwey* Lacepède, 1801:551-552.

Ophicephalus lata Hamilton, 1822:63.

Ophicephalus indicus McClelland, 1842:583.

Ophiocephalus affinis Günther, 1861:470.

Common names: **spotted snakehead**; green snakehead; dolla or daula (Pakistan); taki, lata (West Bengal, India); phool-dhok (Bihar, India); duloora, daula (Punjab, India); soal (Jammu, India); gorissa or godissa (Orissa, India); matta-gudisa, burada-matta (Andhra Pradesh, India); korava-patti (Tamil Nadu, India); kayichal, arracan (Kerala, India); korava, juchi, belikkorava (Karnataka, India); (Talwar and Jhingran, 1992); cheng (northern Bengal, India; Shaw and Shebbeare, 1938); mada kanaya (Sri Lanka; Pethiyagoda, 1991).

Native range: Kabol (Kabul) River basin, Afghanistan, eastward through Khyber Pass into Indus River basin, Pakistan; rivers of the plains of India; Sri Lanka; southern Nepal (Edds, 1986a,b, 1993; Shrestha, 1990; Pethiyagoda, 1991); Bangladesh; Myanmar; eastward to Yunnan Province, southwestern China (Coad, 1981; Talwar and Jhingran, 1992). Musikasinthorn (1998) reported that this species is not present in Myanmar (replaced by *Channa panaw* in the Ayeyarwaddy (=Irrawaddy) and Sittang River basins), and reports from Yunnan Province, China, are probably misidentifications. He further stated that the eastern terminus of the range of *C. punctata* is the Ganges-Brahmaputra River basin. Jhingran (1984) lists this species as absent from Sri Lanka, but Pethiyagoda (1991) and Devi (1992) included Sri Lanka within its native range.

Introduced range: Smith (1950) reported this species from the vicinity of Delagoa Bay, Maputo, southern Mosambique, considered an introduction from Asia (Teugels and others, 1986). Jim Cambray, Albany Museum, Grahamstown, South Africa (personal commun., 2001) located the specimen (AM/G3714) and provided a digital photograph to us. It appeared to be a specimen of *Channa striata* rather than *C. punctata*. We borrowed the specimen through Jim Cambray and confirmed that it is *C. punctata*. Paul Skelton (Rhodes University, Grahamstown, South Africa; personal commun., 2001) reported the specimen as having come from the Museum in Lourenco Marques, Mozambique, and added that no other snakehead has been found or reported from that area since the Smith (1950) record. This indicates that snakeheads are not established in southern Africa.

Size: To 30-31 cm (Bardach and others, 1972; Talwar and Jhingran, 1992).

Habitat preference: Stagnant waters and muddy streams on plains of Pakistan and India, and abundant in muddy waters up to 600 m (Talwar and Jhingran, 1992). Shaw and Shebbeare (1938) recorded the species from "muddy or clear streams and ponds from 2,000 feet" (610 m) "downwards." Quayyum and Qasim (1962) described preferred habitat in India as ponds with "a swampy bottom" and abundant aquatic vegetation, as well as ponds with sand or gravel substrate and no vegetation; they added that "large numbers can live together in a small body of water." Kumar and Mittal (1993) found habitat preferences included open water to very dense masses of vegetation in Keoladeo National Park, Bharatpur, Rajasthan, north-central India. This species is reported to tolerate a wide range of pH levels with 100 percent survival over 72 hours from pH 4.25 to 9.4 (Varma, 1979). It is unable to tolerate salinities above 6 ppm (Mansuri and others, 1979). Nevertheless, Khora and Rao (1994) recorded this snakehead as present and of commercial importance in Bahuda Estuary, Ganjam District, Orissa, India; this estuary drains into the Bay of Bengal.

This airbreather can live indefinitely without rising to the surface if water is well oxygenated (6.0 ml/L and above), but will die within 2-3 hours at an O_2 level of 2.79 ml/L if access to the surface is prevented (Pandey and Chanchal, 1977).

Temperature range: The native range extends from about 34º N southward to about 7º N and altitudes up to 1,830 m, suggesting the species can exist in temperate (for example, Kabol River basin of Afghanistan) to tropical regions. Jain and Garg (1984) provided an upper lethal limit of 40 ºC and lower limit of 9 ºC for fish acclimated to 30 ºC, but found seasonal differences. Those collected during summer months tolerated a high of 40 ºC and a low of 2 ºC, whereas those captured in winter showed an upper limit of 36 ºC and a low of 4 ºC.

Reproductive habits: Dehadrai and others (1973) noted that snakeheads in India are sexually dichromic and dimorphic, and during the breeding season, males and females of *Channa punctata* become deep yellow ventrally up to the lateral line, with many small melanophores in the ventral area of males and black blotches in females. Moreover, females have a circular genital opening whereas in males the opening is elongated.

Said to be a prolific breeder, with pairs spawning (in India) throughout the year, peaking before and during monsoon months (Jhingran, 1984; Talwar and Jhingran, 1992). Reaches sexual maturity in 1 year. Like many other snakeheads, this species builds circular nests in nearshore vegetation, and the eggs are pelagic and guarded by both parents. Most initial guarding appears to be by the female parent. Should the young be disturbed, the female follows the young and the male parent joins her, sometimes charging an intruder and sometimes leaving and swimming into deeper water, at which point the female attacks and drives away the intruder. Feeding by parents continues during protection of the young, and when one parent leaves the young, the other guards (Quayyum and Qasim, 1962). The nest, described as cup-shaped

(Chacko and Kuriyan, 1947), is about 22-23 cm in diameter. Breeding typically occurs at night, and takes place twice each year (Raj, 1916). Kahn (1924) stated that this species builds elaborate tunnels to the nest through surrounding vegetation. Jhingran (1984) indicated that reproduction in ponds occurs through most of the year. The larger the parents, the more offspring they produce. Fecundity is between 2,300 to 29,600 eggs, with egg diameter peaking at slightly less than 0.5 mm. This information is in contrast to that presented by Kahn (1924) who recorded egg size as 2 mm. Khan (1924) also stated that hatching occurred in 54 hrs at 16-26 ºC and 30 hrs at 28-33 ºC. Protection of young continues for 15-20 days until juveniles become demersal (Quayyum and Qasim, 1962). Spawning in southern Nepal occurs from June until August (Shrestha, 1990). Lowe-McConnell (1987) gave April to July as the spawning period in Punjab Province, India, citing brood size as up to 500 individuals; guarding occurs for up to a month or until young are 10 cm long. Reddy (1979) stated that spawning occurs once per pair during July to October, with maximal spawning between July and August in Andhra Pradesh Province, southeastern India. This agrees with Bhuiyan and Rahman (1984) who reported a single annual spawning between April and August in Bangladesh. It appears that spawning season is largely correlated to active monsoonal periods. This is one of three species known to spawn in ponds lacking vascular aquatic plants (Parameswaran and Murugesan, 1976b).

Joshi and Sathyanesan (1981) reported finding stage I oöcytes in testicular tissue of 2 of over 100 specimens of *Channa punctata*, all collected in December when the species is reproductively inactive. Oöcytes were scattered through the testis and the gonads appeared to be a normal testis externally.

Feeding habits: Young (1.5-3.0 cm) feed primarily on zooplankton, with rotifers, insect, and crustacean larvae constituting most of the diet. Adults consume fishes, insects, and aquatic vegetation (Quayyum and Qasim, 1962), the latter probably ingested in the process of capturing animal prey.

The species is an opportunistic feeder. In canals and irrigation ponds near Guntur, Andra Pradesh State, India, stomach contents consisted of 13 species of small fishes with young of *Channa punctata* (one each) found in only three individuals, indicating that cannibalism is rare. Fish bones, scales, fin rays, etc., were common. Insects comprised the second tier of ingested food, followed by crustaceans, tadpoles, and an annelid worm. No algae were found, but parts of leaves and seeds were occasionally observed. By far, the most common food item was fishes (Reddy, 1980). In contrast, in polluted Hussainsagar Lake, Hyderabad, Andra Pradesh State, insects and their larvae were preferred (59.5 percent), followed by fishes and fish larvae (12.5 percent), annelids, algae, leaves, crustaceans, amphibians, and gastropods (Reddy and Rao, 1990). In ponds, tanks, and canals in the central delta area of River Godavari, Andra Pradesh, only 24 percent of the diet consisted of fishes, but 41.6 percent were crustaceans. Dutta (1994) found insects dominant (up to 100 percent) in young (3.1-4.5 cm in length) followed by crustaceans (up to 25 percent) and fishes, except for the months of June, July, and November when no fishes were found. All individuals above a length of 5 cm contained fishes. This study was conducted on specimens captured from Gadigarh Stream, Jammu, northern India.

Wee (1982) cited a study by Panday and Dwivedi (1974) in which it was shown that *Channa punctata* has well-developed olfactory organs in the nasal sacs and taste buds extending into the esophagus, concluding that this species locates food by odor. He also cited Gerald (1976b) as reporting maximal feeding activity of this species occurs at 28 ºC. Food absorption efficiency was reported as 95.5 percent (Gerald, 1976a). Larger fish have a lower feeding rate than young (Gerald, 1976a).

Characters: Body elongated, mostly rounded; 4 or 5 scales between orbit and angle of preopercle, 12 or 13 predorsal scales; pelvic fins more than half the length of pectoral fins, extending to anal fin; pectoral fins plain, no vertical bands, 15-16 rays, about 75 percent of pectoral fin length; anal fin rays 28-37; dorsal fin rays 28-32, rarely 33; caudal fin rounded. Mouth large; lower jaw with 3 to 6 canines behind a single row of villiform teeth that widen to 5 or 6 rows at jaw symphysis. Predorsal scales 12; scales in lateral series 37-40; scales on top of head large, arranged in a rosette between orbits, the frontal scale of which has an open lateralis pit, forming the center of the rosette (Talwar and Jhingran, 1992; Jayaram, 1999). Life colors vary from black to pale green on dorsum and sides, ventral sides white to pale yellow, sometimes with red tinge; several dark blotches on lower sides; occasionally black spots on body and dorsal, anal, and caudal fins. Dorsal, anal, and caudal fins dark gray, sometimes with reddish edge; pectoral and pelvic fins pale orange (Talwar and Jhingran, 1992).

Commercial importance in the United States: Although occasionally listed on aquarist-oriented websites and in aquarium fish books, this species does not appear to have been important to the aquarium fish trade in North America. It is not known to have been imported for culture or live-food fish market sale.

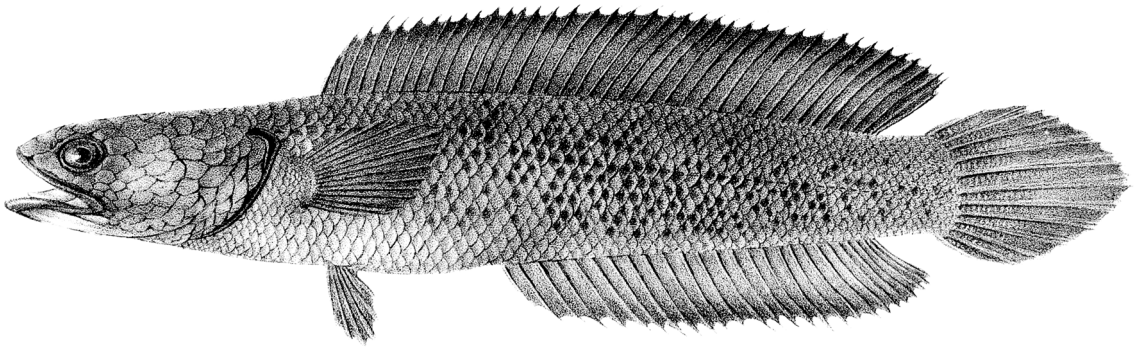
Commercial importance in native range: Snakehead fishes in general are regarded as important fishery resources in India and elsewhere, fished commercially and some species utilized in aquaculture. Quayyum and Qasim (1962) reported this species as "the main bulk of pond fishery in the plains of northern India." Rao and Durve (1989) reported *Channa punctata* as one of three snakehead species fished commercially in Lake Jaisamand, the oldest reservoir in India. They are considered to be a delicacy and demand high prices (Talwar and Jhingran, 1992). Pethiyagoda (1991) noted that it is popular as a food fish in Sri Lanka and is also used as bait for catching larger snakeheads.

Environmental concerns: Because of their voracious, carnivorous feeding habits, snakeheads are regarded as pests in India due to their devastation of other fishes (Talwar and Jhingran, 1992), apparently in pond or culture situations where other desired species exist.

Comments: Banerjee and others (1988) recorded the diploid chromosome number of *Channa punctata* as 32. Dhar and Chatterjee (1984), however, found two groups, one with 32 and another with 34, indicating a species complex.

Channa punctata

Channa stewartii (Playfair, 1867)
Golden Snakehead



After Playfair, 1867

Original description: *Ophiocephalus stewartii* Playfair, 1867:14, pl. 3. On the fishes of Cachar. Proc. Zool. Soc. Lond. 1867(1):14-17, pl. 3. Type locality: Cachar, Assam, India. Syntypes: BMNH 1867.2.14.19-20.

Synonyms: None known.

Common names: **golden snakehead**; Assamese snakehead; sengalee (Assam, India; Talwar and Jhingran, 1992); helae (Nepal).

Native range: Endemic to Brahmaputra (upper, middle, lower) River basin of India and Bangladesh, and the Ganges River basin from southern Nepal southeastward (Sen, 1985; Talwar and Jhingran, 1992; Musikasinthorn, 2000). In southern Nepal, it occurs in the Kamala, Bagmati, Koshi, Gandaki, and Karnali River basins (Shrestha, 1990).

Introduced range: Introductions unknown.

Size: To 25.4 cm (Sen, 1985).

Habitat preference: Flowing and standing water (Talwar and Jhingran, 1992); marshes and estuaries, and tolerant of limited salinity (Sen, 1985). Sen and Dey (1984) recorded this species from altitudes above 1,500 m in Meghalaya, a plateau north of Bangladesh and south of the Brahmaputra River, India.

Temperature range: No specific information. Native range is about 22-27º N, indicating a warm temperate to subtropical species.

Reproductive habits: No specific information, but probably a nest builder providing eggs and young with parental care.

Feeding habits: No specific information, but likely a thrust predator like other snakeheads.

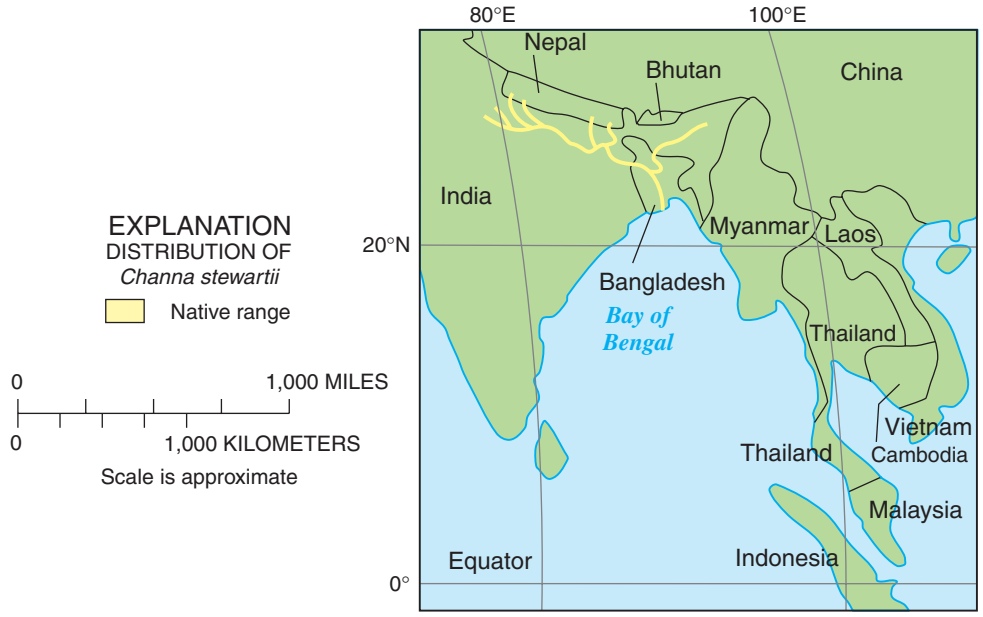
Characters: No patch of scales on gular region of head. Dorsal fin with 39-40 rays; anal fin rays 27. Pelvic fin about one-third as long as pectoral. Lateral line scales 47-50; scale rows between preopercular angle and posterior border of orbit 4-5; predorsal scales 13. Dorsal fin originates above base of pectoral fin. Black spots on many body scales.

Commercial importance in the United States: Rarely mentioned in aquarist-oriented websites but available through aquarium fish trade. Not known to be available in live-food fish markets.

Commercial importance in native range: Talwar and Jhingran (1992) stated that this species is of only minor fishery interest.

Environmental concerns: Likely a thrust predator, feeding on other fishes and invertebrates.

Comments: The diploid chromosome number of *Channa stewartii* is 104 (Rishi and Haobam, 1984).



Channa stewartii